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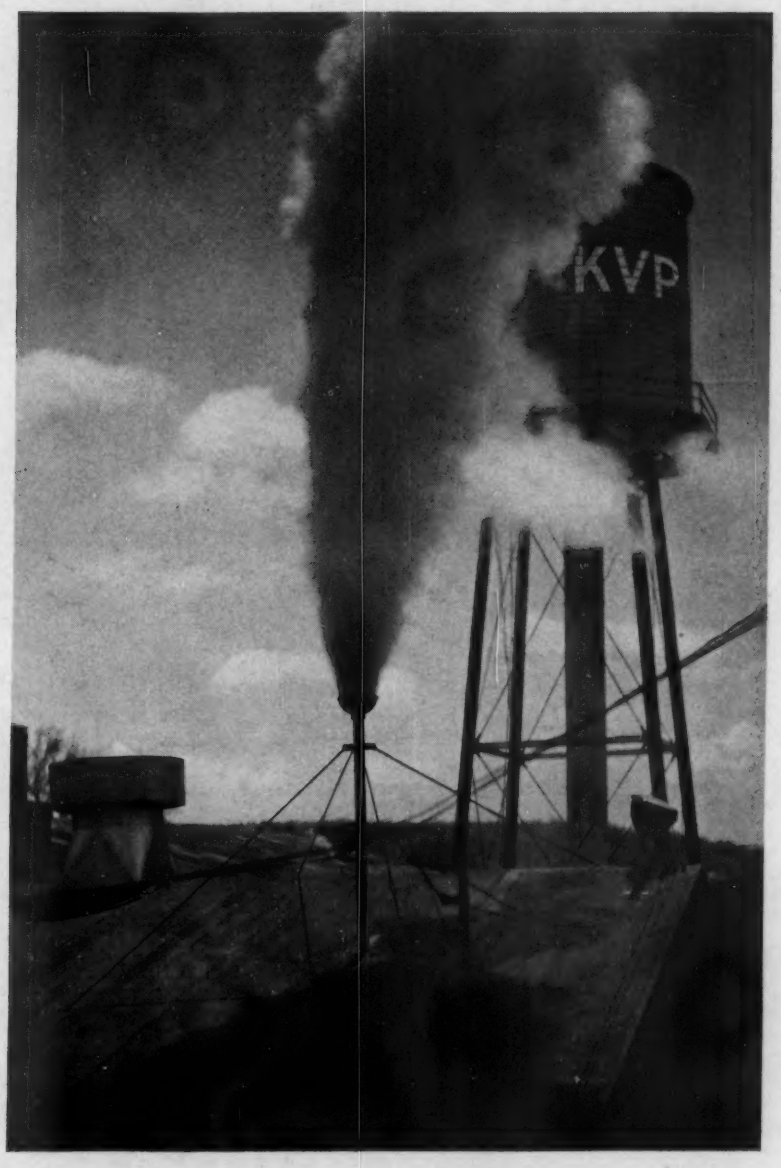

FEATURING

A Defense of Short Selling

By RICHARD WHITNEY, President New York Stock Exchange

OCTOBER VOLUME XIV

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OCTOBER, 1933
VOLUME XIV
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VOLUME XIV OCTOBER, 1933 NUMBER 5

A DEFENSE OF SHORT SELLING

By RICHARD WHITNEY

President New York Stock Exchange

MUCH of the controversy which so long has attended discussions of short selling arises from an initial misunderstanding of just what a short sale really is. Perhaps the most fundamental characteristic of short selling is that it creates a debt in terms of goods. This situation is apt to seem strange and unnatural to us because we are all so accustomed to express debts in terms of money. Yet a moment's reflection will show us that it is no more unfair to owe someone a dinner, a hat, or ten shares of stock than it is to owe him ten dollars.

Photo by Blank-Stoller, Inc.

As a matter of historical evolution, debts contracted in goods are undoubtedly older than money debts. When Esau sold his birthright to his brother Jacob for a mess of pottage, he was really making a short sale. Long before money was invented, men must have bartered and trafficked with each other in similar ways. Nor do we need to go into the distant past of the race for examples of such goods-contracts. During the recent financial troubles, when certain American communities were for the time being deprived of their ordinary banking facilities, barter at once sprang up and contracts in terms of goods began again to be made. Unemployed persons would agree to pick a farmer's vegetables or fruit for a share of the crop. In some communities, coöperative industries were established which made little or no use of money, but which were based upon contracts in raw or finished materials.

In certain types of business, contracts involving goods are entered into year in and year out. Building contractors are a familiar example. They agree to deliver certain construction for a certain sum under certain conditions. In most cases, at the time of making such contracts they do not own the bricks, lumber, and other materials which they thus agree to sell. They may not even have made arrangements to obtain the necessary labor. If the prices of such materials and labor exceed their estimates, they may experience severe financial losses, while if such prices fall they may obtain more profit than they originally anticipated. As long as prices can fluctuate, such elements of financial risk cannot be eliminated from contracts requiring a considerable period of time for their consummation.

The simplest form of the short sale consists in a contract to deliver some form of property other than money at a future time. On the produce exchanges it is possible to sell wheat, cotton, and many other staple commodities for future delivery, and European stock exchanges have sometimes established similar facilities for the future delivery of securities. It is also possible to do this on the New York Stock Exchange, and the practice is by no means unknown. But the latter market as a rule handles the short sale as a cash transaction between buyer and seller, and borrows the securities sold from a third party. If, for example, Mr. Jones were selling wheat for future delivery to Mr. Smith, a simple time contract would be made. But if Jones were selling stock short on the New York Stock Exchange, and Smith were the purchaser, Jones would borrow from Mr. White the stock sold, against a loan of money to White of equivalent amount, and deliver the borrowed stock to Smith. Ultimately Jones would buy the stock, return it to White and recover the funds which he loaned to the latter. Thus the technique of short selling on the Stock Exchange is to this extent more complicated than in

time or term markets. But this does not change the basic character of the operation itself.

II

Practically always in periods of sharply declining prices, short selling and short sellers come in for severe criticism from those individuals who find their securities or commodities becoming less and less valuable. This is entirely human, but it is not sound from an economic standpoint. At such times one hears the old complaint that it is unfair for anyone to sell what he does not own, and superficially considered such activities might seem unusual and questionable. Yet here we must proceed with caution, for unconsciously such an assertion amounts to condemning any use of credit. The merchant who borrows one thousand dollars from his bank in order to stock his shelves with hardware or textiles purchased from a wholesale house, is really exchanging or selling funds which he does not own in return for goods. From an ethical or moral standpoint there is no reason to condemn debts created in terms of goods and justify debts in terms of money. Both are uses of credit, both are necessary to the smooth conduct of business, and both involve speculative risk to the borrower.

Of course, one would condemn a man who by misrepresentation sold something which he knew he could not obtain later on by purchase. In this class would fall the legendary swindler in New York who is said to have made it a practice to sell the Brooklyn Bridge to innocent visitors in the metropolis. But this is, of course, an entirely different matter from entering into a contract to deliver some regularly marketable and purchaseable form of property like staple commodities or listed securities. Many years ago Napoleon objected to short selling on the Bourse until his finance minister called the Emperor's attention to the habit of Paris water carriers who for a fee paid in advance would deliver water to householders. "But," expostulated Napoleon, "that is simple enough. They have merely to go to the river and fill their casks." "Yes, sire," replied the minister, "and on the Bourse there is such another river of securities."

As a matter of fact, most publications require payment of subscriptions months before they are delivered, and some editors who most earnestly challenge the ethics of selling what one does not actually own at the time are unconsciously guilty of that very practice themselves.

A more serious criticism of short selling is that it artificially depresses prices and unsettles confidence. But here again we must proceed with caution and consider the known facts of the case. It is, of course, plain that short selling does not exert any permanent effect upon prices, because the short seller must ultimately purchase just as much as he sells. This is not the case, however, with the outright holder of securities, who is always at liberty to sell out and then to abstain indefinitely from purchasing.

On the other hand, selling by short sellers has temporarily the same effect as any other sales in increasing supply, absorbing demand, and thus depressing prices. But because of this fact we must not rush to the conclusion that whenever the stock market declines it can be attributed to this cause. There are really six different sorts of buying and selling in the stock market: purchases and sales by outright holders who do not use credit at all; purchases on credit or margin and the subsequent sale of the securities so purchased; and short selling and short covering. Statistical evidence shows that the last-named factors — short selling and short covering — constitute only a small part of the total purchases and sales in the stock market, and to attribute great price movements in the stock market to short selling would be to accuse the tail of wagging the dog.

It is of course true that any form of purchase or sale is capable of misuse. The constitution of the New York Stock Exchange clearly recognizes this fact in its "demoralization clause," which reads as follows:

"Purchases or sales of securities or offers to purchase or sell securities, made for the purpose of upsetting the equilibrium of the market and bringing about a condition of demoralization in which prices will not fairly reflect market values, are forbidden, and any member who makes or assists in making such purchases or sales or offers to purchase or sell with knowledge of the purpose, or who, with such knowledge, shall be a party to or assist in carrying out any plan or scheme for the making of such purchases or sales or offers to purchase or sell, shall be deemed to be guilty of an act inconsistent with just and equitable principles of trade."

Under the constitution, conviction of the offenses mentioned in this rule can result in the suspension or expulsion of the guilty person or persons from membership in the Exchange.

The spacious interior of the New York Stock Exchange

Through the long and difficult months when security prices were so steadily and so severely declining, the Business Conduct Committee of the Exchange maintained a vigilant watch to see that no breach of this rule occurred. Close examination of the source and character of the selling which occurred gave continual proof that tremendous liquidation of securities held outright and on credit, plus a lack of normal confidence among security buyers due to the deepening depression itself, was the real cause of falling prices, and that talk about "bear raiders" and "bear pools" was fantastic fiction. As soon as business itself gave signs of stabilizing, there came a speedy end to such wild and baseless assertions.

III

Students of short selling have long defended the practice on the grounds that it served to stabilize prices and to enable the steady maintenance of a free and open market for securities.

It is too much to claim that short selling of itself will always check or prevent over-enthusiasm in the stock market and a consequent inflation in prices. Certainly no such result was seen in the summer of 1929. Yet that extraordinary period is by no means typical of security markets as they operate year after year. In any case, even though occasionally ineffective, short selling is in itself a valuable counter-force to undesirable upward swings in the market of a temporary character. In 1929 many stocks which were not listed on the Exchange and normally not subject to short selling because of the difficulty of borrowing them for delivery, exhibited even more violent upward as well as downward price movements than did average listed shares. Most losses by investors are due to the purchase of securities at exaggerated prices, and for this reason, the short seller is of real service to the investor.

Even more important is the service of short covering. In every stock market there are times when buying becomes inadequate in comparison with selling. It takes unusual courage for the outright investor to purchase in the face of continually depressing economic news, reduced or omitted dividends, shrinking earnings and corporate receiverships. The buyer of securities on credit is often in an even more precarious position, because even though he may have sufficient confidence in the future, previously declining prices may have so reduced his resources that he is unable to buy. In fact he may against his will be compelled to liquidate the securities which he already has for what prices they will bring, and thus intensify the severity of the fall in prices. At such times there remains the man who has earlier sold short. Ultimately he is a compulsory purchaser because he has contracted a debt in terms of stock and sooner or later he must purchase the stock to settle it. What is more, it is just when prices are breaking sharply that it is to the self-interest of the short seller to turn buyer and cover his commitment, for it is just at such times that his chances for making the greatest profit arrive. Here, then, is an emergency source of purchasing, without which at times the maintenance of a free and open security market would prove impossible. Ingenious theoretical substitutes for short covering have sometimes been suggested, such as the establishment of minimum daily prices. In practice, however, there is no workable substitute which to the same extent will stabilize prices and keep the market functioning.

Another use of the short sale is in connection with hedging operations. An investor may hold, say, five hundred shares of steel and wish to protect himself against a possible decline in its price. By selling an equal amount of the stock short, he can eliminate this risk, at the cost of foregoing any chance for profit through rising prices. For if prices rise, the appreciation on the stock he holds outright will be exactly offset by his paper loss on his short sale, and conversely if prices fall, his paper profit on the short sale will just offset the depreciation on the stock he holds outright. Thus, paradoxically enough, although the short sale in itself is undoubtedly an instrument of speculation, it must be employed if speculative risk in holding or owning securities is to be avoided.

The short sale is also constantly employed in the stock market for other essentially non-speculative purposes, and its use greatly facilitates the readiness and ease with which purchases and sales of securities can be made. One such use often occurs with orders to sell stocks which are sent to the Exchange from considerable distances. An investor in San Francisco — let us say — may wish to sell one hundred shares of some stock listed on the New York Stock Exchange. It may be necessary or desirable for him to sell at once, and delay might prove costly. But his security certificate is three thousand miles away from Wall Street. Accordingly his New York broker can sell his stock, borrow other stock, and deliver to the buyer, and when the investor's stock arrives in New York turn it over to the stock lender and thus terminate the transaction.

Short selling is also necessary to the efficient conduct of the odd lot business. On the New York Stock Exchange the ordinary unit of dealings in stock is in lots of one hundred shares. Purchases and sales of lesser amounts, except with inactive stock issues, are handled by a special class of "odd lot" dealers, whose business consists in buying one hundred share lots and selling the stock out in lesser blocks, and also in selling one hundred share lots and purchasing odd lots against them. The nature of this business compels the odd lot dealer to be at times short of stock and also to borrow and lend stocks. These operations partake largely of the nature of a hedge, but any interference with short selling would increase the risks of the odd lot dealer and make his services to the public proportionally more expensive in practice. Such a result would be particularly undesirable in discouraging thrift and investment among the millions of small investors all over this country who purchase stock in less than lots of one hundred shares.

IV

One very impressive aspect of the question of short selling consists in the experience which most of the leading countries have had in attempting its abolition by law.

The first important attempt of this sort was made as early as 1610 in Amsterdam, on whose stock exchange trading in shares originated. Under decreasing earnings the shares of the Dutch East India Company had fallen in price, but the directors of the Company saw fit to blame the movement on "bear raiding." A sympathetic government accordingly legislated against the short sale, despite the protests of the Amsterdam Stock Exchange. The law proved impossible of enforcement, and after continued controversies on the subject through the remainder of the century, it was finally repealed.

England had much the same experience. In 1733 Parliament passed Sir John Barnard's Act prohibiting short selling, but here again the law was found to be undesirable and unworkable, and soon became a dead letter, although it was not wholly repealed until 1860. Again, after the banking panic of 1866, the charge arose that runs on London banks had been instigated by "bear raids" on their shares on the London Stock Ex-

(Continued on page 101)

Extracurricular Opportunities At Technology

A Brief Survey of Undergraduate Activities

By CARROLL L. WILSON '32
Assistant to the President
Massachusetts Institute of Technology

The author because of his experience as an undergraduate in the management of sports and as Chairman of the Budget Committee and a member of the Executive Committee of the Institute Committee, is in a position to appreciate and understand the significance of activities at Tech. In his present position he has the added advantage of being able to view activities as a whole and to understand the point of view of the Administration toward the students' participation in activities. — EDITOR.

THE accompanying chart gives some impression of the breadth and scope of the undergraduate activities at the Institute, the extent of which is seldom realized even by those who have been actively associated with one phase or another of the extracurricular life. The chart, however, cannot give the reader an understanding of the distinctive character of the government and management of the undergraduate activities, and it is one purpose of this article to point out the exceptional opportunities for personal development and executive experience which are open to those students who enter actively into undergraduate affairs. It is, unfortunately, the impression of many students who come to the Institute that because there are no intercollegiate football or baseball teams there can be little else of significance to constitute an interesting undergraduate organization. It is hoped that the following discussion will show the reader that the very absence of such spectacular intercollegiate teams enables the undergraduate to conduct his affairs with a far greater degree of freedom than would be possible if other conditions existed. Finally, one other erroneous notion regarding participation in extracurricular activities should be corrected, that is, the idea which prevails in many places that the academic work of the student is so extremely rigorous and exacting as to preclude the possibility of his devoting any time to pursuits which are other than those of a scholastic character. In refutation of this, attention is called to the fact that the scholastic ratings of students engaged in activities are consistently well above the average. This apparent anomaly is probably only further evidence of the validity of the truism that "the more work one has to do, the more work one can do and do well."

Before proceeding with a description of the present organization, it is desirable to point out two particular characteristics of the system. The first is the unusual degree of self-government and management of the undergraduate body as a whole and of the individual components. Particularly is this true of the management of athletics, which in most institutions has been largely taken away from the undergraduates because of the magnitude of operations which has resulted from intercollegiate football. The second characteristic which distinguishes the Institute activities is that no undergraduate is allowed to derive any personal monetary profit from the operations of any activity with which he may be connected. This latter point is of extreme importance because it causes the student to approach activities with an entirely different point of view from that which he might entertain if there were a promise of financial remuneration.

At the top of the undergraduate organization is the Institute Committee, the representative governing body of the undergraduate life. This committee was formed in the early 1890's in response to a need of both the undergraduates and the Institute Administration for some body acting with power to supervise, guide, and coördinate the various fields of undergraduate activity and to act as a centralized means of contact between the activities as a group and the Institute Administration. Functioning through its executive committee, class officers, and subcommittees, the Institute Committee exercises active control over all undergraduate activities. It is responsible to the Institute Administration for the proper conduct of all student activities, and its powers are commensurate with its responsibilities. Its treasurer, who is also chairman of the Budget Committee, is responsible for all disbursements for the immediate operations of the Institute Committee, for the classes, and for all expenditures of the Athletic Association. Of its subcommittees, two deserve special mention. The first is the Walker Memorial Committee which has charge of the Walker Memorial Building and exercises supervisory control over all functions which are held there. The second committee is the Student Curriculum Committee whose membership consists of the student members of the Student-Faculty Curriculum Committee, a group of students and faculty members whose function it is to meet and discuss, among other things, suggestions for the revision of courses which students believe to be poorly administered or from which they feel that they derive little benefit. Thus there is always available an opportunity for students to bring their suggestions and criticisms to the attention of the faculty through a channel specifically intended for that purpose. Among the groups which come within the jurisdiction of the Institute Committee is the Dormitory Committee which is the governing body of the five hundred or more men residing in the dormitories. There are no proctors in the dormitories, inasmuch as the government and enforcement of regulations are under the control of the student residents.

It is noteworthy that with regard to the conduct of athletics at the Institute, it was found, in connection with a survey of college athletics which was conducted by the Carnegie Foundation for the Advancement of Teaching several years ago, that Massachusetts Institute of Technology was among four institutions which represented the greatest degree of undergraduate management out of more than one hundred included in the survey. As a complementary body to the Athletic

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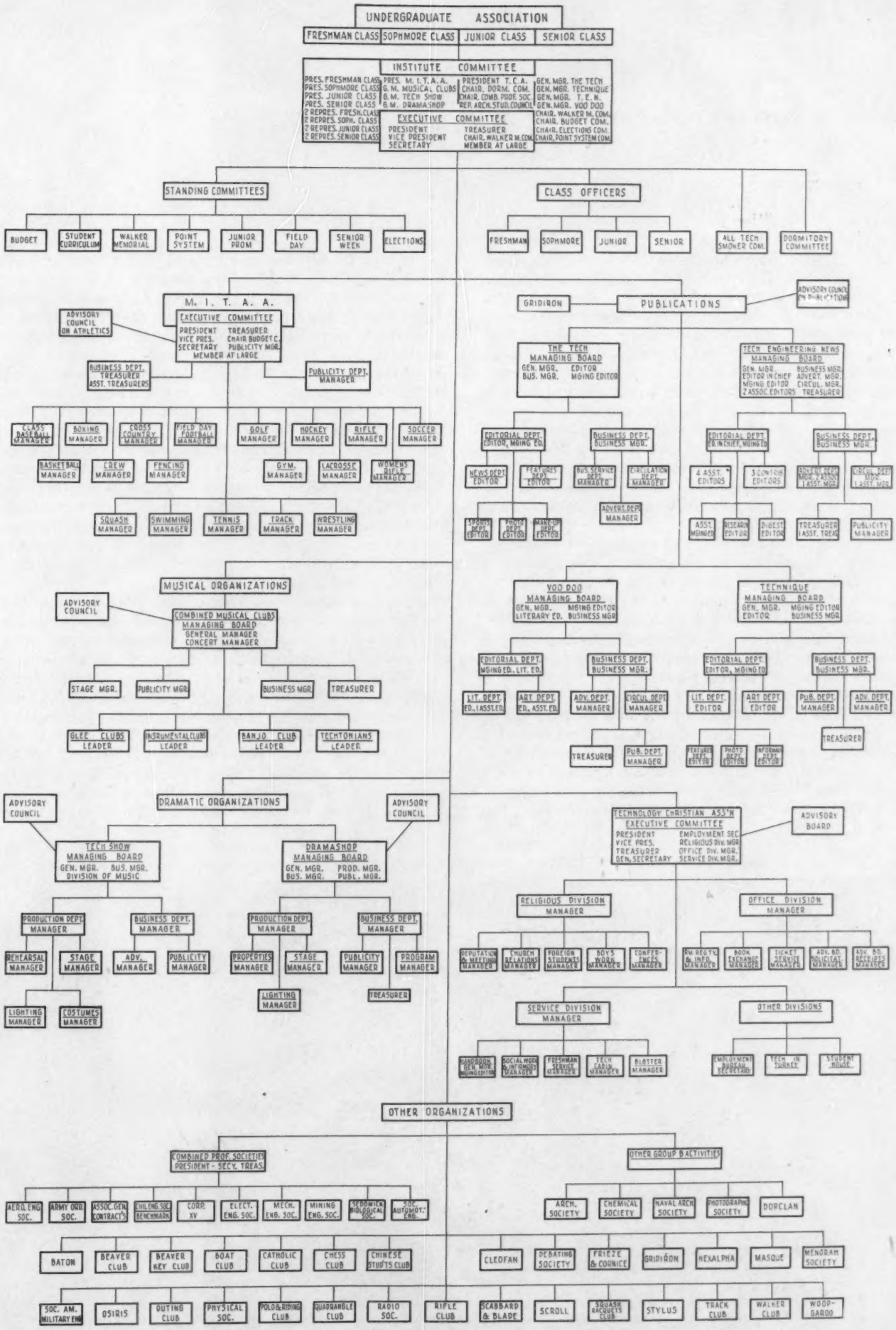


Chart showing the undergraduate extracurricular organization at Technology

The Development of

THE MODERN CRUISER

By HENRY E. ROSSELL, COMMANDER (C.C.) U. S. N.
Professor of Naval Construction

IN recent years the design, construction, and performance of cruisers have been of great public interest, particularly in this country. The reasons for this interest may be traced back to the early days of the World War when the exploits of a few small German cruisers thrilled belligerents and neutrals alike.

Perhaps the best known of these sea raiders was the *Emden*, a vessel of only 3,500 tons displacement and armed with ten four-inch guns. For several months after the outbreak of the war this ship roamed around the Indian Ocean and nearby waters, preying on enemy shipping. All told she sank some 70,000 tons of British merchant ships, in addition to a French destroyer and a Russian cruiser of about her own size. During her long cruise the *Emden* was able to maintain herself by replenishing her fuel and stores from captured ships. The *Emden* met her end when she was overtaken and destroyed by a larger and more powerfully armed Australian cruiser, the *Sydney*.

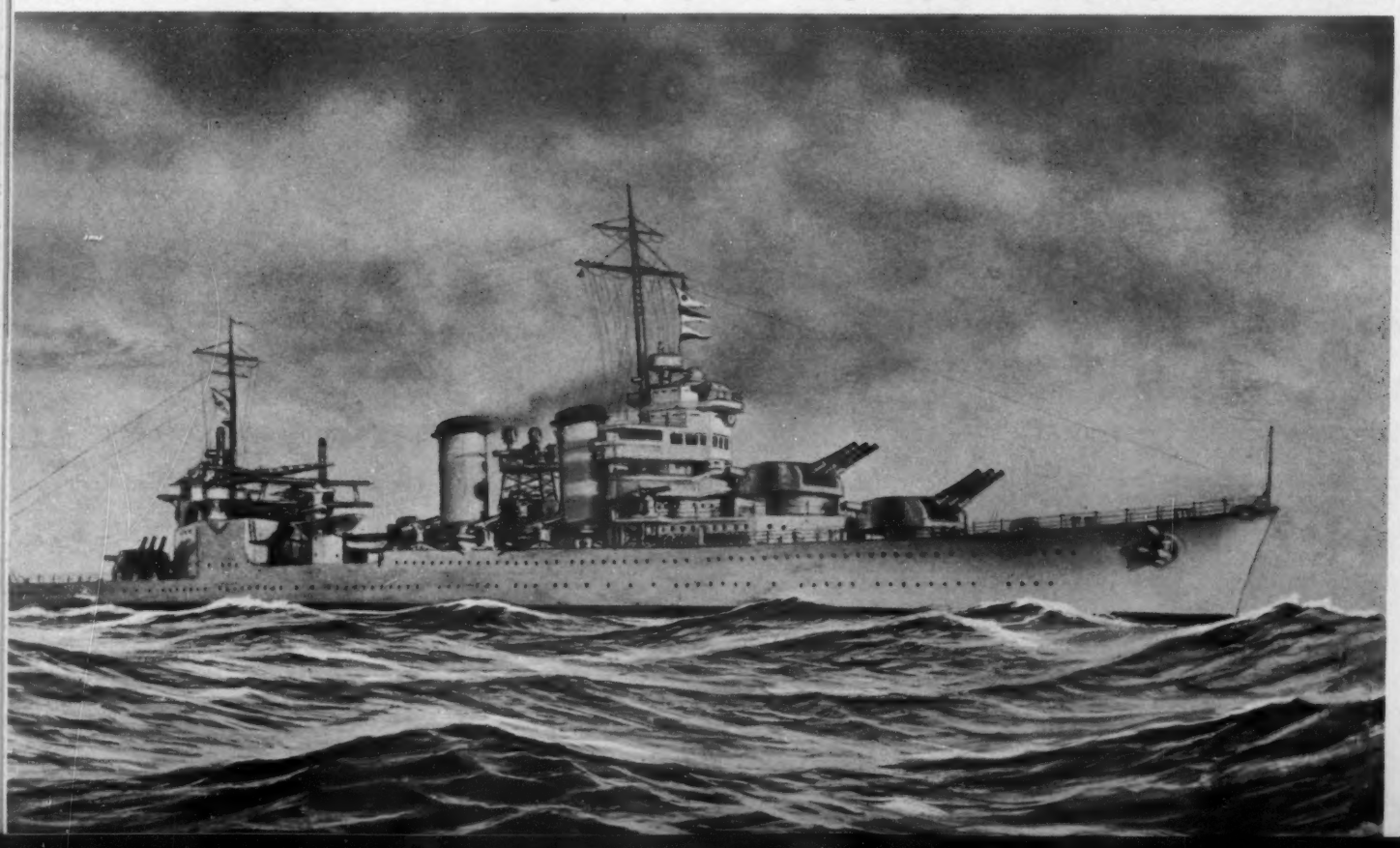
The depredations of German cruisers on the commerce of the allied powers, though highly spectacular, were of small military importance. In fact they had no effect whatever on the outcome of the conflict. It was in the fleet actions of the war that the more important functions of this type of ship were demonstrated. These may be explained best, perhaps, by a consideration of the history of cruiser development.

From about 1890 cruiser design developed along two divergent lines. The first led to a ship with a belt of comparatively heavy armor along the water line and with guns of rather large size, in some ships as large as nine or ten-inch. In addition to these primary battery guns, a number of smaller guns, three to six-inch, were carried for protection against torpedo vessels. The speed was about twenty-five per cent greater than that of contemporary battleships. Ships of this type were given the name "armored cruisers." The type was inaugurated in 1890 by the French in the *Dupuy-de-Lôme*, a ship of 6,500 tons displacement and twenty knots speed. At first naval powers showed but little interest in armored cruisers. In the Russo-Japanese War they gained great prestige, however, as a result of the excellent work done by Japanese armored cruisers at the battle of Tsushima. Here they were able to keep their stations in line of battle in opposition to Russian battleships.

Subsequently armored cruisers were built in large numbers by all of the great naval powers. By 1906 such ships had reached a size of some 15,000 tons, made a speed of about twenty-four knots and carried guns as large as ten-inch. The armor belt was about six inches thick, and generally an armored deck was fitted to resist shell which might penetrate the belt. Armored cruisers of this period were almost as large as contemporary battleships, but they were inferior to the latter in all respects except speed.

Designers were counting, apparently, on these ships to take part in fleet actions against enemy battleships as they had done at Tsushima. Certain very important events had taken place in the meantime, however, which seem to have been overlooked by armored cruiser advocates. The penetrating power of artillery had been increased greatly without corresponding improvement in armor. Moreover, revolutionary developments were taking place in methods of control of gun fire. A third important factor was the introduction of the all-big-gun battleship, or dreadnaught, a vastly more powerful ship than its predecessors. At the same time England

e U.S.S. New Orleans, *which was launched on April 12, 1933, at the Brooklyn Navy Yard* *Transactions of the United States Naval Institute*



Battleships of the United States Navy at target practice

Army Ordnance

brought out the battle cruiser, essentially a high speed dreadnaught with slightly inferior armor protection.

The advent of the battle cruiser caused the virtual abandonment of further construction of armored cruisers after about 1908, but at the outbreak of the World War the latter type still held much of its earlier prestige. Most naval officers felt, however, that it could not be relied upon any longer for duty in the battle line at fleet actions. Its functions were to be commerce destruction and protection, scouting, patrol, and convoy duty.

The German ship *Blücher* (1908) was among the most powerful armored cruisers ever built. She had a displacement of 15,550 tons and a speed of twenty-five and three-fourths knots, and carried twelve 8.3-inch guns in addition to a battery of smaller guns. Her side armor had a maximum thickness of about seven inches, but her deck armor was rather light. At the battle of Dogger Bank the speed of *Blücher* proved to be insufficient to enable her to escape the British battle cruisers. Their 13.5-inch shell penetrated her protective deck at a range of about 17,000 yards and exploded beneath it. After having been reduced to a state of helplessness by two hours of artillery bombardment, the ship was sunk by a torpedo from a British destroyer.

Other armored cruisers offered less stubborn resistance. The war was only a few weeks old when three British ships of this class, namely the *Cressy*, *Aboukir*, and *Hogue*, fell easy prey to a lone three hundred ton German submarine. A few months later at the battle of Falkland Islands the crack German cruisers *Scharnhorst* and *Gneisenau* were sunk with little difficulty by two faster and more powerful British battle cruisers. At Jutland four of England's best armored cruisers ventured to within some ten or twelve thousand yards of the head of the German battle line, which consisted of battle cruisers and battleships. About two minutes of fire from the heavy German ships disposed of three out of the four British cruisers. One blew up at once, another blew up during the following night, still another sank some hours later, while the fourth escaped.

These experiences and many similar ones led to a general lack of confidence in armored cruisers. They were too weak to fight heavy ships and too slow to avoid action against more powerful vessels. Moreover they were not suitable for scouting duty because of their poor speed and excessive size. On patrol or convoy duty they made attractive and none too resistant targets for enemy submarines. All were agreed that armored cruisers had few merits and many shortcomings, in short that they were obsolete. So ended one line of development, which had started in 1890 with the French *Dupuy-de-Lôme*.

During the nineties the British navy did not look with favor upon armored cruisers. It preferred the so-called "protected" cruisers. In these there was no side armor, in lieu of which an armored or "protective" deck was placed over the vitals or perhaps over the entire length of the ship. Ordinarily the deck was sloped down on either side so that it joined the ship's side several feet below the water line. The crown or flat portion of the deck was placed several feet above the water line so that shell holes in the side of the ship would not admit water over the entire surface of the deck. This system of protection had been introduced in 1880 in the Italian battleship *Italia*.

Many of the British protected cruisers of the nineties were of large size and carried relatively heavy guns. For example, the *Terrible* class (1895) was of 14,200 tons displacement and carried two 9.2-inch guns as well as a number of six-inch guns. It soon became apparent, however, that ships of such large size were not required for commerce destruction and protection. This seems to have been the primary duty for which they had been designed. Thereafter there was a gradual reduction in the size and armament of British protected cruisers.

All of the other large navies built protected cruisers during the nineties and the early years of the present century. Most of them were of moderate size, from 2,000 to 8,000 tons. The ships had been designed for commerce destruction and protection, but they reflected in their widely divergent characteristics the uncertainty as to just what qualities were desirable for work of this kind. Some carried heavy guns while others were lightly armed. For example the Japanese *Matsushima* class (4,200 tons) had a single 12.6-inch gun on each ship besides smaller guns, while the Russian *Bogatyr* class (6,500 tons) carried only three-inch and six-inch guns. Speeds ranged from as low as sixteen and one-half knots to twenty-five knots.

At the battle of Yalu in the Sino-Japanese War, ships of the *Matsushima* class were extremely inefficient. They could not make effective use of their 12.6-inch guns, for which great sacrifices in other characteristics had been made.

Among the miscellany of ships of the protected cruiser type, the Russian *Novik* (1900) pointed the way toward future development along rational lines. This vessel was of only 3,000 tons displacement, but she made a speed of twenty-six knots, very high for the time. She carried six 4.7-inch guns and five above water torpedo tubes, and had a protective deck of two-inch thickness over the vitals.

During the Russo-Japanese War protected cruisers were unable to keep position in the battle line at fleet actions, but they proved of great use in other respects. In the preliminary stages of an action they were used for scouting. During an engagement they served to give

(*Continued on page 102*)

Lessons Learned from
THE CALIFORNIA EARTHQUAKE
by Engineer and Architect

By EDGAR LLOYD HAMPTON
Los Angeles, California

WHAT Southern California now knows about earthquakes should prove of practical value to every American community, because the evidence acquired as the result of a disaster which wrecked scores of buildings and cost close to a hundred lives reveals in detail the sort of buildings that are susceptible to earthquake shocks, and those that are immune.

In the beginning it should be stated that the reports which flew thick and fast across the continent, following the débâcle, were luridly exaggerated. There was no tidal wave, there were no burning cities, Southern California was not reduced to ruins, and Los Angeles was not destroyed.

What actually did occur, according to the seismologists, was that a quake of minor, not major, intensity, starting beneath the ocean about two miles offshore, and some fifty miles from Los Angeles, traveled landward, invaded an area consisting of about two counties, lasted fifteen seconds, killed eighty-nine people (including those who died later) and caused about $45,000,000 of property damage.

This wood frame residence was moved from its foundations by the oscillations because it was not anchored, yet it was not structurally injured

Long Beach, with a 150,000 population, was the greatest sufferer. The loss in that city totalled fifty-one lives and about $25,000,000 in property. The town of Huntington Park, with 24,000 population, and Compton with 12,500, suffered in about a like proportion, while a dozen smaller communities were similarly injured. The damage in Los Angeles was of very minor importance. Out of its 1,250,000 population only three persons lost their lives, while not even one of the city's 350,000 structures was destroyed. However, many of the older buildings suffered superficial injury, and some of the better types were forced to replace broken windows and repair cracked plastering.

The evidence made available, and which should prove of use to every city and town in the United States, came from the reports of a score of eminent engineers and other experts who were employed by city and county governments to investigate the disaster, determine its cause, and discover, if possible, why certain buildings were razed, while others remained uninjured. These experts also laid their findings before a coroner's jury of nine outstanding architects and engineers, from various parts of the country, who later issued a lengthy report on the causes and extent of the disaster, with detailed recommendations regarding the character of material and the types of buildings that should be exclusively used in future construction work, not only in Southern California, but also in all other areas where there is a possibility of earthquakes.

The reason buildings suffer during an earthquake, even of minor intensity, is because of the peculiar habits of the quake itself. It has three distinct motions, one of which is a slow, horizontal movement accompanied by shorter and more rapid vibrations. These short vibrations travel back and forth, and it is this back-and-forth movement which disturbs the structure's equilibrium. The seismographs showed that in the California temblor this movement at its extremest intensity was three and one-eighth inches, while the score of small quakes which followed within the next two weeks moved only one-eighth of an inch.

The seismologists all agree that the California affair was not a major quake, that it was only of moderate intensity. Yet it was sufficient to wreck scores and even hundreds of buildings in the various communities visited, and it is out of the findings of the jury of experts regarding the types of buildings that were injured, and those that remained immune, that a valuable object lesson becomes available to anyone engaged in the building industry, whether he be the architect and engineer, or the capitalist who furnishes the cash.

The jury, after ten days devoted to taking evidence and studying documents, reported that the buildings which failed did so invariably for specific reasons. First, because they were old — it was the out-of-date buildings, the Class C type, or worse — that were the chief sufferers. Second, because of faulty construction and careless supervision and inspection. Frequently these old buildings were insecurely anchored to their foundations, and some were not anchored at all — they were simply set up on cement blocks or piles. Third, the outer walls and partitions were not properly tied together and so failed to withstand the shock. "Lack of bracing and adequate tying in of structural members caused walls to separate and fracture, and either partially or totally collapse," reads the jury's report, and this was especially true of fire walls insecurely anchored, the falling of which caused more than half the deaths.

Another reason for the failure of these Class C structures was poor mortar, which in far too many cases consisted of lime instead of gravel and cement, while, next to the faulty fire walls, the principal cause of the fatalities was directly traceable to inadequately reinforced brick towers and chimneys, to cornices not properly tied in, and to fancy decorations over door-

ways. "It was an outstanding fact," the jury stated, "that the greatest hazard from falling materials was in the entrances of the buildings. Stability of construction was often sacrificed for architectural effect."

A final reason why a major amount of damage occurred as a result of a minor shock, was that in none of these structures had the builders made provision to offset horizontal motion — in other words, lateral stress. This brings us back again to the peculiarities of an earthquake, which has three distinct motions, instead of one. A tornado has one motion — a steady, forward pressure. An earthquake, however, moves more or less elliptically — it oscillates — thus disturbing the building's equilibrium. As a consequence, if the building is old, and not properly tied together, its walls may separate and fall. And they may fall in, or out — due to the back-and-forth movement. One of the peculiarities of the recent quake was that it "kicked" some walls north and some south, within a half-block of each other. In like manner a cornice not properly anchored may lose its equilibrium and fall, and the same principle applies to elaborate decorations constructed over doorways. Finally, if the building is not anchored to its foundation, it is certain to meet disaster. What really occurs is that, due to the earth's horizontal motion, the foundation moves suddenly sidewise, and the superstructure fails to follow it. The defects above enumerated applied only to the old structures, such as are to be found in any city, including the newer communities of the Pacific Coast.

On the other hand no Class A building was more than superficially damaged anywhere within the entire area, including those which stood in the very center of the disturbance. "No building properly constructed was structurally damaged," said James I. Ballard, member of the American Society of Civil Engineers and staff writer for the *Engineering Record* of New York, who inspected the area following the shock. "If buildings in the area had been built as we now know how to build them, the damage would have been slight," said Dr. Bailey Willis, former president of the Seismological Society of America, and professor emeritus of geology at Stanford University, while the jury of experts added this authoritative comment: "Buildings reasonably well designed, and efficiently constructed according to good architectural and engineering standards, sustained a minimum, if any, damage. If all the buildings in the area had been correspondingly designed and constructed this fact would have probably forestalled the loss of lives."

Since, unfortunately, there was a loss of life, the district attorney, who sat in at the coroner's inquest, persistently and properly tried to establish individual responsibility. The jury, however, though it did find abundant evidence of poor workmanship, careless inspection, and lack of foresight, discovered no grounds to justify the criminal prosecution of anyone, chiefly for the reason that they took into account a number of other facts which the casual observer would naturally overlook.

For example, they knew that in the entire history of Southern California, no one had ever been required to build a structure to resist cyclones and tornadoes, since these forms of disaster have never visited the community. Also the thermometer seldom sinks as low as the freezing point, thus eliminating the necessity of building against blizzards, or even frost. Another point which the jury took into account was the unprecedented growth of Southern California during the past dozen years or so — a growth which increased the population of such towns as Compton, Huntington Park, and Long

An example of an old masonry structure built with lime mortar and with its walls and partitions not sufficiently tied together

Beach from two hundred to one thousand per cent in a single decade, thus multiplying their building problems to a point where mistakes were inevitable. One of the mistakes was that, a decade ago, these towns had no adequate building codes at all, which is not surprising since no village ever has an adequate building code.

Thus when a quake of but minor intensity visited these towns, they suffered major damages, and the jury of experts severely criticized them for "lack of foresight." And they did show lack of foresight — the same sort that we all showed before October, 1929, when no one could have convinced us that any negative thing could possibly happen to American securities.

While the extent of the disaster should in no sense be minimized, the final records show that the aggregate results were far less than the public was at first led to believe. The thousands who were reported dead shrank to eighty-nine. The damage to physical property was also greatly overstated. To the facts, as announced by the various experts, that no Class A building within the shaken area suffered any major injury, and that all the important buildings erected within the past few years were of the Class A type, we add the following statement from the jury's verdict: "An outstanding fact was the large percentage of buildings which came through without serious damage. Fully 78 per cent of the buildings in the affected area suffered only inconsiderable damage, and another 20 per cent suffered no damage which could not be readily repaired."

These figures refer not to the percentage of property loss, but to buildings, numerically, and, as already stated, many hundreds of the Class C type were badly injured. Regarding the comparative property loss, the local Chamber of Commerce published a statement to the effect that of 120 communities in Southern California only eight were badly damaged, while in an area assessed at $7,000,000,000 the total loss did not exceed $45,000,000.

The jury found that wood frame buildings, whether finished with wood or stucco, generally suffered very little; that manufacturing buildings suffered damage to masonry, but otherwise not seriously, and any provision calculated to safeguard masonry buildings would have prevented this damage. They found that stucco stood up very well, that steel frame buildings suffered only incidental damage, the most of which could have been avoided by proper design, and that reinforced concrete

(*Continued on page 104*)

THE TECH ENGINEERING NEWS

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EDITORIALS

FACT AND OPINION

A MAN'S opinion is no more valuable than the evidence it is based on. For this reason what one thinks is not so convincing as why he thinks it. So important indeed is this truth that in a court case only an expert is allowed to express an opinion; others must confine their testimony to a recitation of what they saw and heard, *i.e.*, *why* they think as they do. The twelve good men and true can then form an intelligent opinion of their own and know why they hold it.

"On what subjective evidence do you base your opinion?" is a question which should be heard often in the classroom and particularly in the laboratory. It trains a man really to think, not just to repeat what the text or the professor has said.

Examining why you think a thing is so will often result in a rearrangement of conclusions so that they are more nearly in conformity with the facts. On occasion it will even compel admitting that a judgment has been formed as a result of emotion — that enemy of good judgment.

If a student can be trained in the art of thinking, instead of merely in using the tools developed by those who have done thinking, then, even though his thinking be incorrect at first, he will surely come to correct solutions sooner or later because the process is right. As a member of the faculty has said in the introduction to a recent book: "It seems to me far better that the student should come to an inadequate solution by thinking independently, than that he should hand in a paper which merely parrots an idea someone else has digested for him. If the student does not possess reasoning, he cannot possess truth. If he reaches a wrong conclusion by unsound reasoning, he can be converted to a better conclusion by further experience and better reasoning; but if he reaches a conclusion by blind imitation neither better reasoning nor more experience can change his stubborn grasp on a belief he knows not why he believes."

F. ALEXANDER MAGOUN
Associate Professor of Humanics

CLASS OF 1937

THE TECH ENGINEERING NEWS takes this opportunity to welcome the freshmen and transfer students who are just entering Technology. The greater part of the Class of '37 comes to Tech directly from high or preparatory school, anxious to resume its studies on a more advanced and more mature plane than has been possible for it in the past. Whether as a member of that class your primary interest is in architecture, in science, or in one of the various branches of engineering, the

Westinghouse

An unusual view of the vivid illumination at the World's Fair, looking east across the lagoon

Massachusetts Institute of Technology has much in store for you, not only in the way of academic education, but also in athletics, extracurricular activities, and social life.

Tech is vastly different from the preparatory school which you attended. It is assumed with good reason that students come here for the serious purpose of study. Consequently, you will find your new associates a somewhat sober group with their feet on the ground and a definite idea of where they are going. The size of the school may at first seem appalling; the homework assignments may appear to tax your abilities; you may find that other activities permit comparatively little time to be spent in amusement of a social nature, and, if you are away from home for the first time, you may even find that homesickness is adding to your discomfort.

But these factors should not dishearten you even if they may at first dismay you. The same troubles have arisen for most of us, and somehow or other we managed to survive. You will find plenty of compensating features for the slight discomforts which you may encounter.

You will find, for instance, that your new associates are perfectly willing, even anxious to help you out whenever the opportunity arises. You have already observed some of this spirit of helpfulness in your senior advisor; you will find the same readiness to aid in others of the student body.

You will find, once you get to know them, that your instructors likewise are a really human group of good scouts. Although Technology is one of the larger schools in the country, its ratio of faculty members to students is unusually high, so that there is a good opportunity to become acquainted with your instructors. But making the acquaintance of the faculty is up to you, and you will have to take the initiative in seeing that your instructors know you as individuals, rather than as occupants of certain particular chairs in certain particular classrooms. You will find the associations that you make with your professors valuable in more ways than one, and practically every one of them will spend as much time with you as is necessary to straighten out your problem. By now you should be past the stage in which you believed that all instructors were demons whose primary object in life was to ensnare you in pedagogical traps.

You will find opportunities to engage in various forms of athletics, and will be encouraged to go out for a team. The Institute believes that your physical development is as important as your mental expansion. The wide variety of sports available at Tech provides practically everyone with the opportunity to engage in that form of physical activity which best meets his requirements.

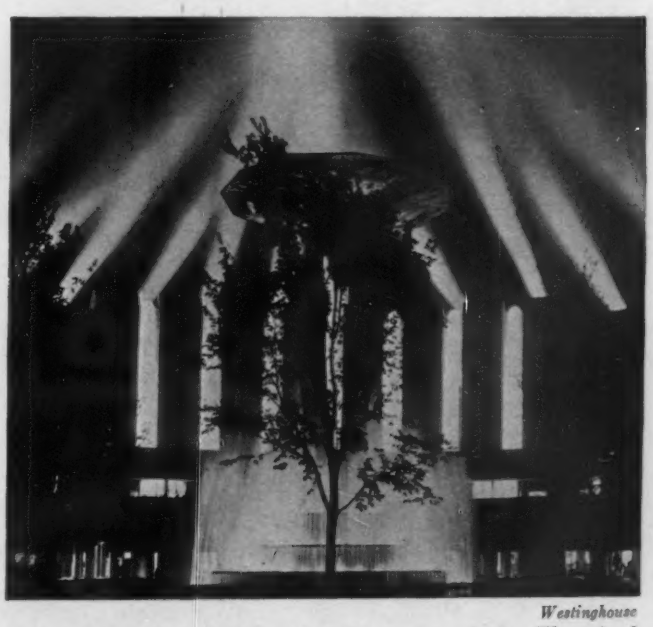
Technology is also well provided with extracurricular activities of a non-athletic nature. If you are musically inclined, you will be interested in the various musical clubs. For those who possess dramatic ability the Dramashop and Tech Show provide opportunities to take part in amateur theatrical productions. The Technology Christian Association, with which you have already come into contact, is always looking for men to carry on its important work. The various publications offer experience in the business, editorial, and advertising sides of the publishing game. Each of the four major publications at Tech fills a definite need in the life of the school, and each is worthy of support.

Go out for one of these outside activities. Make as many friends as you can, for your fellow students will be the ones with whom you will come into contact later in the business world. In short, make the most of your four short college years. And while you should be conscientious about your studies and make every effort to do honest work based on independent thinking, don't become too one-sided and too narrow; that is, to use a popular Tech slang expression, don't become a "brown-bagger."

And so THE TECH ENGINEERING NEWS again welcomes you, with a cordial expression of best wishes for every possible success in the near future.

AN INVITATION

TO the undergraduates, especially those of the Class of 1937, THE TECH ENGINEERING NEWS extends an invitation to participate in the competition for positions on the Staff of the magazine. Whatever your interest may be, there is a place on the T. E. N.—editorial, art, publicity, advertising, circulation, treasury and accounting. It will be to your advantage to become associated with the T. E. N. at the earliest date. A Smoker will be held within the next few days—why not come around and get acquainted?



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The spectacular lighting in the court of the Electrical Building at A Century of Progress Exposition

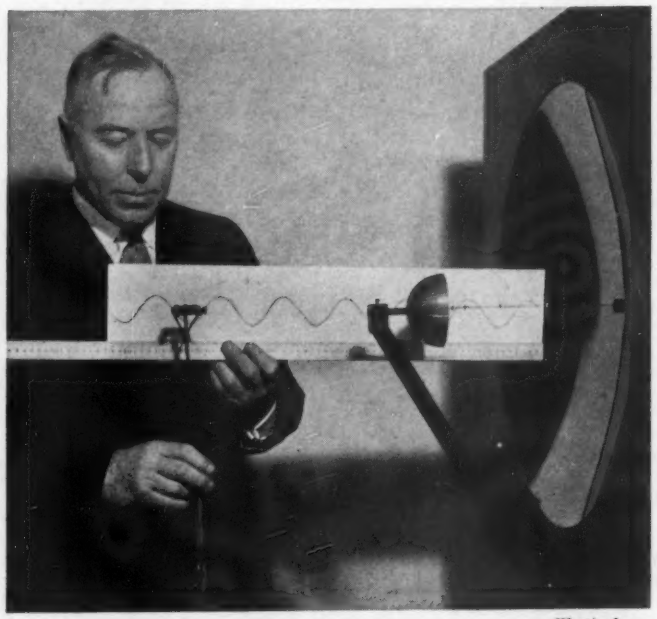
ENGINEERING DIGEST

Condensation of outstanding articles in the trade and scientific journals, published by special permission

LILLIPUTIAN WAVE-LENGTHS

Westinghouse Technical Press Service.

THE most powerful ultra-short wave transmitter, producing nine centimeter waves, is being demonstrated at A Century of Progress Exposition. The power transmitted, approximately one watt, has never been approached by other generators at such short wave-lengths. These waves, unlike ordinary radio waves, do not follow the curvature of the earth but shoot straight into space. Since the ultra-short waves are unaffected by rain, snow, sleet, or fog, the "beam-caster" can be used in place of light signals and other similar devices.



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Measuring the nine-centimeter waves

In a "beamcasting" demonstration, where a conversation was sent through space on an invisible beam of radio waves, a wave-length of nine centimeters was used. In "beamcasting" the sender focuses the waves on a silvered parabolic mirror, which concentrates the rays into a long narrow beam. At the receiver another parabolic mirror gathers the beam and focuses the waves on an aerial less than two inches long. This apparatus has been tested between points over a mile apart, and it is believed that distances up to twenty or thirty miles will not be too great for successful operation.

The radio waves of the ultra-short type have the straight line characteristics of light waves and are reflected by flat sheets of material just as a mirror reflects light waves. Metals give almost complete reflection while non-metals absorb some of the energy.

The direct measurement of the wave-length is an interesting experiment. A metal sheet, placed in front of the transmitter, combines the direct and reflected waves to form standing waves. In the latter there are points where no oscillation of the beam occurs. The distance between two adjacent points of no oscillation is measured. This distance equals one-half the wave-length.

"EVERYTHING BUT THE SQUEAL"

Chemical and Metallurgical Engineering.
August, 1933.

BY using salt water instead of fresh water for cooling purposes in the condensers of oil refineries, The Texas Company obtains valuable products of salt, bromine, calcium chloride, and Epsom salt from the water. The salt water is first pumped to the surface by a well. It is then treated with lime to precipitate the magnesium as hydroxide. The brine is then sent to the refineries where it cools the condensers. In this process it acquires enough heat to partially evaporate the water. When it comes from the condensers, it is passed through spray ponds or towers where the evaporation is carried on until salt separates out and falls into large tanks. It is then taken by conveyors to the washer house where the salt is washed, filtered, and dried to purify it.

The bittern, which is the material left after the salt is crystallized from the brine, is taken from the spray ponds to the bromine tower where it is treated with chlorine in glass stills. By this process of steaming the bittern with chlorine, the bromine is liberated and distilled off. This bromine is then used in the manufacture of anti-knock gasolines.

After the bromine has been extracted, the bittern goes to kettles where it is concentrated. The calcium chloride is then obtained by cooling the concentrate on chilling rolls or in large drums. The rolls chill the bittern to form flakes of calcium chloride, which are used on roads, while the solid calcium chloride in the drums is used largely in refrigeration. The magnesium hydroxide which was precipitated earlier is filtered, washed, and then treated with sulphuric acid to form the crystals of magnesium sulphate or Epsom salt.

FASTEST ELEVATORS

Power.
August, 1933.

THE great seventy-story tower in Rockefeller Center now has the fastest passenger elevators in operation. In all, the huge building has seventy-five elevators, some of which normally travel at the rate of 1,200 feet per minute and have been operated as fast as 1,500 feet per minute. The various elevators travel from 497 to 779 feet and some of them represent a total suspended load of 25,530 pounds. Since the elevators travel at such a high rate of speed, and are in motion about fifty-eight per cent of the time, an entirely new line of equipment was necessary. The fast elevators are each operated by a 100 h.p. motor especially constructed to satisfy the unique conditions. Extremely sensitive controls are necessary to give the speedy elevators the ability to start and stop accurately on long and short runs. In the high-rise cars the rope stretch due to loading and unloading is so great that a special leveling device using a photo-electric cell is used in compensating for the gradual rope stretch.

All the elevators have all the known safety devices incorporated into their design. One of the most interesting of these is the special stopping device in the pit where the elevator would land if it got out of the operator's control. The cables which suspend the cars are

made to stand a large overload, thus providing a large margin of safety. The operator's panel in the car, although simple, gives him complete control over the car. The elevators can be run by automatic or manual control, but the latter is much slower and is used only in special cases.

A few of the elevators are equipped for both automatic express and automatic night service. These and most of the other cars leave the main floor at regular intervals and two Telechron clocks strike bells when the cars are to leave. Another unique feature of the elevator unit is the complete system of signals and lights which enable the dispatcher and operators to keep informed as to the whereabouts of all the elevators and waiting passengers.

ELEVATING WATER

A. K. Isham '01.

AN unusual apparatus has recently been devised to raise water to different heights, the maximum height being not less than twenty-seven feet. Although patented, the device is still in the experimental stage and new improvements are forthcoming. The water is raised by an open coil spring which is endless like a belt. This spring passes around a lower and an upper pulley, the former being submerged in the water. To the upper pulley is attached a geared motor which moves the coil and pulleys. As the coil moves around, the water, by its viscosity, seals the openings and forms a moving "pipe." When the spring speeds up the column of water is carried to the upper pulley where it is thrown off tangentially into a sheet metal trough. On a twenty-seven foot lift with a one and one-half inch coil this centrifugal throw is three and one-half feet.

Naturally, some water drops down during the upward motion but nevertheless the efficiency of the apparatus is high enough to make it an economical piece of machinery. The present apparatus will raise one-tenth of a second-foot of water, for irrigation, with a one-quarter horse power motor, belt reduced to a speed of 270 r.p.m. As the speed needed to drive the apparatus is quite low, water power, hand crank, windmill, or most any available power can be used. Since there are very few wearing parts and no valves, the quantity of water delivered will remain constant during the life of the apparatus. The device can be put to many uses, such as irrigation, fire prevention in isolated districts, placer work in mining, sump, drainage, bilge, and sewer work.

HOW ROUGH?

Automotive Industries.
August 19, 1933.

IRREGULARITIES as small as one one-millionth of an inch can be detected in some finely ground surfaces with the new instrument known as a profilograph. In principle it is very simple. A very sharp diamond point is mounted on a mirror which is hinged to a support. This support moves along over the surface dragging the point after it. A beam of light is now focused on the mirror so that the light will be reflected on a rotating drum which is some distance from the mirror. Upon this drum is placed a sensitized piece of paper. As the tracer point moves over the irregularities, the mirror is wiggled slightly. This motion affects the beam of light which traces a picture of the irregularities on the sensitized paper. The drum is so placed that the motions of the tracer point are magnified about two thousand times, in the vertical direction. This magnification allows irregularities down to ten one-millionths of an inch to be measured accurately and those down to one' one-millionth of an inch to be detected. On rougher surfaces a smaller magnification is used. The horizontal magnifications are controlled by the speed of the drum. Usually a magnification of thirty times is used in the horizontal direction.

The records that the instrument makes are of special importance and show that even in the most careful honing of aircraft cylinders, small irregularities are quite profuse. Manufacturer's samples give a jagged record when put in the machine and the surface of a cylinder bored with a portable tungsten carbide apparatus is shown to be very irregular and rough.

At present, the instrument is a laboratory model and is used on small specimens only. Modifications of the instrument are being considered so that it can be used in regular factory inspection of various parts in automobiles and aircraft. This change would increase the commercial value of the instrument and make it of more practical use.

DIESEL-ELECTRIC LOCOMOTIVE

Westinghouse Technical Press Service.

DOING its work more efficiently than a steam engine, the new 800 h.p. Diesel-electric locomotive of the Northampton and Bath Railroad proved its superiority in several ways. Since the locomotive burns a low grade of fuel, the fuel costs are only about $4 a day, while a steam engine uses about $15 to $20 worth of coal to do the same work. In addition to having this advantage, the Diesel-electric is cleaner, requires no water and has no tender dragging along behind it.

The new locomotive has the appearance of a low coach or car with a raised center compartment or cab. The power is developed by two 400 h.p. internal combustion engines. Directly connected to these engines is a dynamo which generates the electricity. This current is then supplied to motors on the trucks of the locomotive. The operator has an excellent vision from the center cab, and by means of a dual control he has perfect control of the entire mechanism driving the powerful locomotive. This dual control enables him to drive in either direction from either side of the compartment.

The Diesel engine itself uses a heavy furnace oil which is burnt in the cylinders. No spark plugs or other ignition devices are needed as the air in the cylinder, compressed by the piston, becomes hot enough to ignite the oil. This burning in a confined space raises the compression and forces the piston down.

Westinghouse

The Diesel-electric locomotive

RESEARCH IN REVIEW

COURSE I ***Civil Engineering***

A rational theory of flow of clear water through sand, based on Poiseuille's Law of viscous flow in capillary tubes, has been developed with the aid of experiments. This theory will be used as a basis for the development of a workable plan for removing suspended solids by filtration through sand, and apparatus for the experiments to be performed in connection with the development of this theory has been designed and will probably be set up at the Providence Water Purification Plant.

Studies were made of the use of the M. I. T. electrical network analyzer for the solution of hydraulic problems occurring in the design of water distribution systems. A new field was found for the use of this equipment, and hydraulic problems which were hitherto impractical of solution except by very approximate methods may now be solved with this calculating board with acceptable precision.

COURSE VIII ***Physics***

Overshadowing all else in the Physics Department this summer was the Conference on Spectroscopy held during the week of July 17. It was attended by over a hundred representatives from the outstanding research institutions of the country, as well as from many industrial concerns.

Recent research developments in the spectroscopy laboratory have included the successful photography of the spectra of the rare gases, neon, argon, krypton, and zenon, in the extreme ultra-violet with a vacuum spectrograph by President Compton and Dr. J. C. Boyce, and the most accurate wave-length determinations of the spectrum of iridium ever obtained by W. E. Albertson, Gr. VIII; Dr. W. H. B. Skinner of the University of Bristol, and Dr. H. M. O'Bryan of the Institute, have succeeded in photographing spectrum lines of lithium and beryllium whose wave-lengths are only one one-hundredth as long as those of visible light. Dr. J. C. G. Wulff and his students have been studying the structures of exceedingly complicated spectrum lines of gold, cobalt, and lanthanum, and have obtained important new results in this field. Prof. G. R. Harrison has been applying his recently developed mechanical spectrum analyzer to the spectra of the rare earths, and with R. E. Evans, Gr. VIII, and H. A. Robinson, Gr. VIII, has been getting interesting results with the 21-foot vacuum spectrograph in establishing new standards of wave-length for the extreme ultra-violet region.

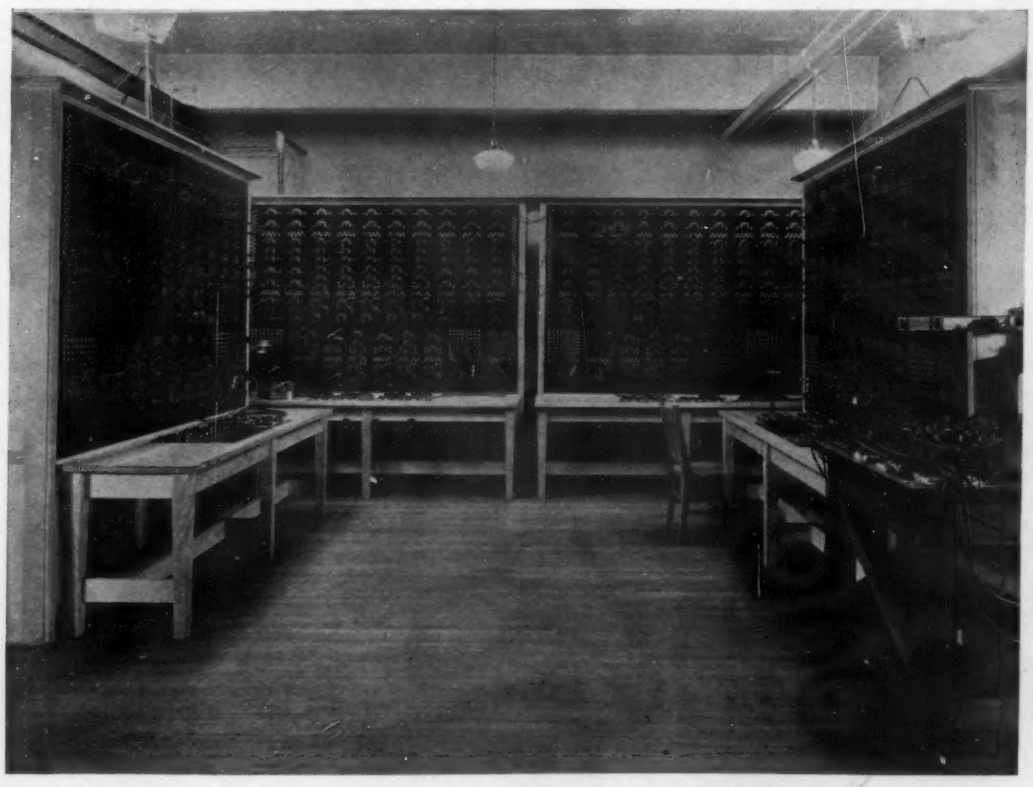
COURSE X ***Chemical Engineering***

Crude rubber is a tough, resistant mass that is impossible to work with. For some years the method of softening the crude rubber has been simply to place it in a miller, which consists essentially of two rollers that rotate in opposite directions. This treatment converts the rubber into a soft gum that is easily rolled or molded. Mr. Squires conducted experiments to determine just what was the nature of the change in the rubber during this process. By building a hermetical hood around the miller it was possible to select the kind of atmosphere in which the process was to take place. Observations in atmospheres of carbon dioxide, nitrogen, and oxygen proved that the crude rubber was not converted appreciably in the inert gases. Oxygen is necessary for the formation of the softer form, indicating that the change is chemical and not merely physical.

COURSE XII ***Geology***

Until recently crystals were considered the most perfect thing in nature. Then Professor Zwicky of the California Institute of Technology found that crystals possessed a super-grid which he called a secondary structure. Prof. M. J. Buerger of the Massachusetts Institute of Technology has proved that this is false. He has found that the actual nature of the imperfection is of a branching, tree-like character, making the crystal no longer the model of geometrical perfection but rather the product of haphazard growth.

Prof. Louis B. Slichter began last summer a series of experiments to determine the resistivity of the earth's crust. It is hoped to collect data on resistivity at depths as great as five miles. This is accomplished by passing direct current into one grounded electrode and taking it out at another some thirty miles away.



Originally designed for use in solving knotty electrical problems, the Network Analyzer has proved valuable in the field of hydraulics as well.

A DEFENSE OF SHORT SELLING

(*Continued from page 89*)

change. In 1867 Parliament passed the "Leeman's Act" which forbade the short selling of bank stocks. This statute, too, has for years been more honored in the breach than the observance, although it has never been formally repealed.

In France the vast currency inflation during and after the Revolution created great speculative activity on the Bourse, and with its collapse came the usual outcry concerning short sellers. Finally in 1802 a law was enacted against the practice. The French commonly disregarded the law, even though under it short sales were declared gambling wagers and unenforceable at law. So things remained until 1882, when France experienced her sharp "Union Generale" panic and vast losses were imposed on her security dealers and investors. At once many angry customers endeavored to plead the law of wager in order to thrust their losses upon their stockbrokers. So scandalous was this widespread attempt to "welch" on security contracts, that in 1885 the law against short selling was abolished.

The classic case of legislation against short selling, however, occurred in Germany where in 1896 a drastic law was enacted prohibiting the practice. But despite the autocratic powers of the Prussian state, the law was frequently evaded. Business in securities shifted to foreign markets, while greater fluctuations were experienced in the Berlin security and money markets. The supposed object of the act in curtailing speculation was not realized, for new evils were created and old evils accentuated. After being condemned by all financial authorities, the act was finally repealed section by section during 1908–1911. On the basis of actual experience, even the original advocates of the measure were compelled to admit its unsound and harmful character.

Finally, in New York State a bill was enacted in 1812 prohibiting the short sale. At that time, however, the question was largely an academic one, as no important volume of dealings in shares had yet developed in this country; the New York Stock Exchange had yet to be formally organized, and the main security market of the city consisted in a small curb market dealing intermittently in ten or fifteen bank and insurance company shares. But when a greater volume of business developed in canal and railway shares, the fallacious nature of the law became apparent, and it was formally repealed by the New York Legislature in 1858.

V

It is characteristic of the complaints against short selling, that they occur almost entirely in periods of declining prices, when the old human urge to find a scapegoat always arises. But when prices are rising, no one ever seems to urge the short seller to go out and halt inflation. This has always been so as long as speculative markets have existed, although the functions of short selling are better understood now than ever before, particularly in countries which have actually tried the painful experiment of attempting to abolish it. As long as speculators for the rise outnumber speculators for the decline, and as long as rising prices seem preferable to falling prices, the relative unpopularity of short selling will doubtless continue. But as long as free and open markets remain desirable adjuncts of our financial machinery, short selling will continue to be needed to perform a stabilizing function for which no actual substitute has ever been discovered.

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REMEMBER YOUR DIVIDEND

MODERN CRUISERS

(Continued from page 93)

the heavy ships protection against attack by torpedo vessels. Throughout the war the cruisers were used for patrol duty and for breaking up attacks by enemy light ships. The Japanese found that cruisers were of great service in the protection of their lines of communication to Korea from the attacks of Russian cruisers. On the whole the experiences of the war seemed to indicate that the primary functions of cruisers had to do with fleet operations and not with commerce destruction.

From 1905 to 1914 many small, fast cruisers were built, principally by the British and German navies. In these ships speed, cruising radius, seaworthiness, and handiness were emphasized. Batteries were light, consisting of guns of from four to six-inch caliber mounted on the deck behind light shields or entirely unprotected. In most cases side armor of two to four-inch thickness was fitted, in addition to a light protective deck. Generally deck torpedo tubes were carried. Sizes ranged from 3,000 to 6,000 tons, and speeds from twenty-three to twenty-nine knots. These vessels were called "light cruisers," a term which is still in use. Among the most successful of them were the ships of the British *Arethusa* class (1913). In this class high speed, twenty-nine knots, and reasonably good offensive and defensive power were obtained on the small displacement of 3,500 tons.

During the World War the *Arethusas* did excellent work in patrolling the North Sea, in scouting, and in leading destroyers in to attack. Indeed throughout the war light cruisers of moderate size, rarely over 5,500 tons, seem to have fulfilled all of their functions efficiently. In fleet actions these vessels were of great use to both sides in ascertaining and reporting the strength and disposition of the enemy, in supporting torpedo attack, and in breaking up enemy torpedo attack. In carrying out these duties they met with surprisingly few disasters. Their protection was sufficient to enable them to engage in protracted engagements with each other. At the same time they were too small to attract the fire of enemy capital ships except on rare occasions. Even then the light cruisers were often successful in escaping by virtue of their great maneuverability, high speed, and small size.

Torpedo tubes were of little or no use to cruisers during the war. Though many torpedoes were launched, practically no hits were obtained. In fact, so far as the writer knows, the only successful torpedo attack from a cruiser during the entire war was one which sank the German cruiser *Frauenlob* during the night action after Jutland.

Normal post-war developments in cruiser design were toward greater displacements and toward slightly higher speeds. These features were incorporated in the British *Frobisher* class (9,770 tons, thirty knots), British E class (7,100 tons, thirty-three knots), and French *Daguay-Trouin* class (7,880 tons, thirty-four knots). All except *Daguay-Trouins* were generally similar to earlier light cruisers. The French vessels differed in that protection was very light and consisted only of a protective deck. All navies gradually adopted airplane catapults as a feature of cruiser design.

In 1922 a most disturbing factor was injected into the problem of cruiser design. This was the Washington Naval Treaty (Treaty for the Limitation of Naval Armament). The treaty set a limit of eight inches on the caliber of guns which could be carried by a ship of displacement less than 10,000 "standard" tons. Standard displacement does not include fuel oil or reserve feed water. By this measure a 10,000 ton ship actually displaces about 11,500 tons when ready for sea.

The Treaty limitations led to the advent of an entirely new type of cruiser. Vessels of this type, which were built shortly after the signing of the Treaty, were armed with eight to ten eight-inch guns in addition to a few guns of smaller caliber. Most of them carried deck torpedo tubes and airplane catapults. Some were fitted with an airplane hangar. Speeds ranged from thirty-two and one-half knots on American and British vessels to thirty-eight knots on Italian ships. All of the earlier Treaty cruisers had very light protection, in some cases insufficient to resist the attack of a destroyer's guns. In their design and construction great effort was made to save weight in order to secure the "most ship" on the allowed weight. Costs were extremely high, because of the weight-saving policy.

Within recent years there has been a strong trend in the design of Treaty cruisers toward increased protection, but even today these vessels are referred to by their critics as eggshell ships. They are styled officially as "heavy cruisers," the old name of armored cruisers being avoided.

The eggshell cruisers have met with very severe criticism abroad, especially in England. The critics claim that these ships are unnecessarily large and expensive, that they are poorly protected, and that their guns are too large. Indeed several foreign powers have abandoned the 10,000 ton cruisers in favor of smaller vessels armed with six-inch guns.

The United States has been a staunch advocate of the 10,000 ton, eight-inch gun cruiser. It has been claimed in this country that eight-inch guns should be carried by cruisers in order that they may be able to dispose of ex-merchant vessels armed with six-inch guns.

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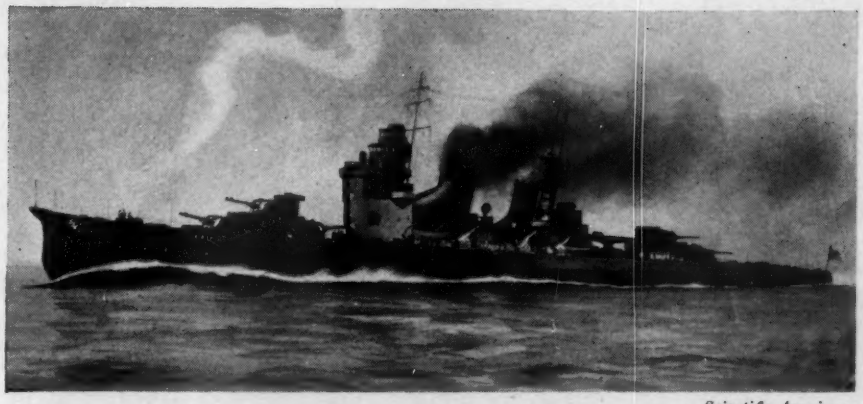

Scientific American

The Japanese 10,000-ton cruiser, Nachi, typical of the powerful ships of Japan's modern navy

Arguments in favor of the large size of Treaty cruisers are based on the claim that this size is essential to obtain the necessary cruising radius.

Whatever arguments may be advanced for or against the Treaty cruiser, however, we cannot escape the fact that during the late war cruiser functions were carried out efficiently by much smaller and more lightly armed ships. Nor can we escape the fact that present 10,000 ton cruisers are so lightly protected that in all probability an engagement between two of them would be decided on the basis of luck. Moreover, to give such a ship adequate protection against eight-inch gun attack would require a sacrifice of speed. The resulting ship might be called a "pocket battleship" or more appropriately by the discredited name, "armored cruiser."

ACTIVITIES

(Continued from page 90)

Association, the Advisory Council on Athletics provides that continuity of policy and background of experience which insures a sound athletic policy. The actual management of the teams, the scheduling of games, the conduct of trips, and the disbursement of money is in the hands of the undergraduate managers under the guidance of the officers of the Athletic Association and the Budget Committee. Students compete during their first and second years for the position of manager which is held by a junior. The officers of the Athletic Association, who are seniors during most of their term of office, are chosen largely from the group of sports managers and therefore have the benefit of actual managerial experience.

The policy of the Advisory Council on Athletics, whose membership includes three undergraduates and in which is vested the authority to make all grants of awards and insignia, is characterized by a meticulous consideration of the eligibility of contestants and a rigid adherence to the principles of strict amateurism.

It may be safely said that there is no trace of commercialism or professionalism in sports at the Institute, and this condition is undoubtedly due, to a considerable extent, to the absence of the intercollegiate football team which dominates the athletic program of most collegiate institutions. It is doubtful that any student ever comes to the Institute primarily because of an interest in one of its teams. Athletics occupy their proper place in the life at the Institute; they provide every element of keen competition and sportsmanship, but they cannot be construed in any instance as transcending in importance the academic work of the Institute. There are no special concessions or immunities granted to those who are competing on Institute teams. This is a proper and healthy condition. The recruiting of athletes from secondary schools, the granting of athletic scholarships, and the devices for putting a desirable athlete, but a poor student, through examinations so that he may be rigorously trained for spectacular intercollegiate contests bringing a revenue of many thousands of dollars and attracting to the institution the attention of thousands are practices which are all too common among American collegiate institutions. Such actions are certainly contrary to the professed purposes of institutions of higher learning and are degrading to the institution, to sport, and to the man himself.

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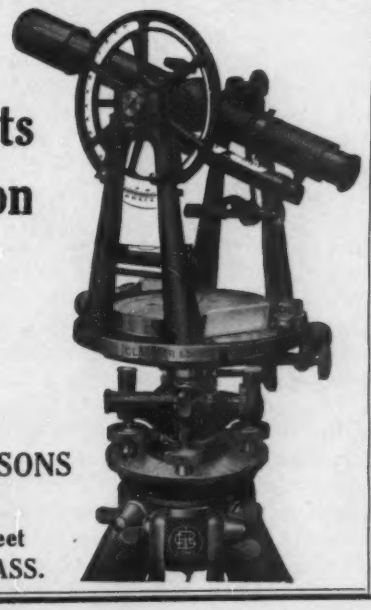

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As indicated on the chart, each of the publications is independently organized with the Advisory Council on Publications acting in an advisory capacity to the group. The system of advisory councils for such organizations as the Publications, the M. I. T. Athletic Association, the Technology Christian Association and the Musical Clubs constitutes a fortuitous solution to the problem of affording to these groups the benefit of the advice of an older group of men and at the same time savours in no way of meddling on the part of the Institute Administration. They are groups elected by the Alumni Council of the Alumni Association and in most cases include in their membership student representatives from the various activities concerned. Inasmuch as these various activities trade on the goodwill of the Institute, it is desirable and proper that they should have the benefit of the counsel of an interested group of alumni who are organized essentially as an advisory group but who are empowered to act with authority to protect the best interests of the Institute and the activity in case the need for such action should arise.

The Advisory Council on Publications holds and invests the trust funds of the various publications. These funds represent the accumulation of profits from operations. As pointed out before, there is no financial return to those engaged in the management of any undergraduate activity, and, in the case of the publications, such profits as may be realized in excess of the necessary operating capital are turned over to the Advisory Council to be invested and held in trust.

Engagement in the many phases of work connected with the composition and management of the publications gives the student excellent opportunities for expression and development of his talents and interests.

The Technology Christian Association offers opportunity for service in a number of fields of interesting work. Likewise the Musical Clubs, the Dramashop, and the Tech Show provide the undergraduate with further variety in his choice of an extracurricular pursuit. As is evident from the chart, there are a number of professional societies and clubs so that it should be possible for every student to find at least one phase of the extensive undergraduate organization in which he is interested. The chart is not entirely complete and does not show the twenty odd social fraternities nor the rather extensive organization of the various halls of the dormitories. The fraternities, although not under the jurisdiction of the Institute Committee, constitute a large group in the undergraduate body and have a representative on the Institute Committee.

A student who neglects his academic work because of his participation in activities, even though he may occupy a key position, can expect no special consideration from the faculty. However, this should not be construed as meaning that the Institute Administration does not look with favor upon undergraduate activities. On the contrary, it has been the attitude of the Administration for a number of years that such activities occupy an important place in the life of the Institute and should be encouraged.

The manifold opportunities in the direction of personal development, executive experience, and the formation of life-long friendships with classmates and officers of the Institute cannot be fully appreciated by the undergraduate who is just approaching this new phase of his life. The fact that a high percentage of the graduates of the Institute eventually find their way into executive positions should be an incentive to the undergraduate who engages in the management of undergraduate activities and he should have a distinct advantage over his colleagues, who in most cases must wait until some years after graduation before they secure their first experience in executive work. A record of achievement in undergraduate activities is, of course, a factor of no small importance when a student is seeking his first position.

The freshman's first venture and approach to one of the activity offices is naturally one of some strangeness and hesitancy, but it cannot be urged too strongly that every student who can possibly do so should make a real effort to enter actively into the undergraduate life. He will find there a miniature world in which participation in its activities will call into play and develop those qualities of personality, integrity, and persistence which are inevitably vital factors in determining a man's ultimate success in life. It will repay dividends of which he can have no conception at the outset of his career. A perfect coördination of scholastic, extracurricular, and social activity should be the aim of every student; only when the latter two, as well as the former, enter into his undergraduate life can he really partake of the broad education which the Institute offers and fully enrich both his intellectual and social being.

CALIFORNIA EARTHQUAKE

(*Continued from page 95*)

buildings always held, even without provision for lateral stress.

Having outlined the types of buildings unable to withstand earthquake shocks, and the reasons for their failure, the jury set forth, in detail, the types which they stated would pass safely through an earthquake many times more severe than the one under consideration, and they urgently recommended that these types be employed in all future construction work in the area. The report also included a list of rigid requirements regarding material and methods of construction. These were at once incorporated into building codes by the various city and county governments, and are already being employed not only in the reconstruction work, but in all other buildings now in process of construction in Southern California.

Meanwhile, as a final safeguard against any quakes that may visit Southern California in the future, a uniform building code is now being formulated, which will apply equally to the entire state. Such a code has been in process of development for a number of years. In 1928 a fairly effective list of regulations was adopted by approximately one hundred building inspectors belonging to the Pacific Coast Building Officials' Conference, and it is now being used by eighty-six cities and towns in California.

The new code will be yet more exacting and likewise more scientific. Its evolution is in charge of a group of experienced architects and engineers, aided by the engineering experts of Stanford, the University of California, the California Institute of Technology, and the Massachusetts Institute of Technology. For many years past these four institutions have scientifically studied the effects of earthquakes on synthetic structures and have arrived at new formulæ for the construction of stronger buildings.

These formulæ will become a part of the state's new building regulations, and it must be apparent that a code thus conceived out of bitter experience, plus scientific knowledge, will be of direct value to building engineers throughout the entire nation, in view of the fact that earthquakes are no respecters of persons, and that no one can know beforehand where they may strike next.

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BEMOTORED BEHEMOTHS

The same sun which never sets on an unshaved Englishman's chin likewise never finishes its daily round without seeing electric motors put to some new use.

In the Sinclair Refining Company's exhibit at "A Century of Progress," you can see five prehistoric monsters. Largest is a Brontosaurus, 70 ft. long and 22 ft. high, with a steel skeleton and welded joints, posing on a mountain. Little motors operate his eyelids, head, neck, mouth, breathing apparatus, and tail. A motorized Tyrannosaurus rocks back and forth, blinking and running out his tongue. A 30-foot Triceratops lunges forward; a Stegosaurus waves his fins; and a Duck-billed Dinosaur sits in a lake and churns water with his tail.

Interviewed recently, and speaking for the group, Brontosaurus shrewdly winked an eye and recommended G-E motors, on the basis of his 80 million years of experience.

WATCHDOG

Like Malone of the Mounted, old PM-13 always gets its man.

When the storm king rides roughshod along transmission lines, this new G-E automatic oscillograph waits to see the whites of his eyes. Then it starts recording within a half cycle (of a 60-cycle wave), a speed made possible by a special little mirror with a movement all its own. On a single roll of the sensitized paper, PM-13 can handle as many as a hundred oscillograms of chance transients and surges, and they can tread right on one another's heels or follow months apart.

When power surges sign their names, it's no forgery. The signature shows true wave shapes and phase relations. And, best of all, the PM-13 is permanently connected in the circuit and runs by itself.

Incidentally, Claude Hathaway, a U. of Colorado graduate in 1927, is largely responsible for this new development.

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We take you now to our new indoor weather laboratory.

General Electric has "commandeered" this ten-room house in Schenectady and dedicated it to improving the air we breathe. Two G-E engineers —Elliott Harrington, Beloit College, '16, and Leon Mears, U. of Minnesota, '30, live there and conduct tests. Air conditioning (temperature control, humidity regulation, air cleansing, air circulation) flourishes. There is automatic oil heating; there are extensive air ducts in the walls, in the floors; room coolers; combination units to deliver air either heated or cooled; filtering, humidifying, and circulating devices. Air currents can be produced—vertical or horizontal. To help summer cooling, a ventilator exhausts air from the attic. With thermocouples located in nearly a hundred places, temperature readings are taken at one point by means of a telephone-relay system.

This residence was one of the proving grounds for the G-E oil furnace. Now it develops design principles for air-conditioning equipment.

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